Eastman products for
industrial wood coatings
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Beauty meets performance

Formulators of industrial wood coatings and finishes need to make them clear, beautiful, and durable while balancing cost and value. They must satisfy important market drivers such as higher performance, protection capabilities, optimized unit cost, appearance, and regulatory requirements. Eastman has a broad range of raw materials for industrial wood coatings applications that can help formulators meet each of these needs—ensuring quality is never compromised.

We offer solutions for finishes on residential furniture, office and institutional furniture, cabinetry, building products, and other wood-based composite applications.

Eastman product families for industrial wood coatings

**Cellulose esters**
- Eastman cellulose acetate butyrate (CAB)
- Eastman Solus™ 2100 performance additive

**Eastek™ polymer dispersions**
- Eastek 1000, 1100, 1200, 1400

**Solvents**
- Ketones
- Esters
- Alcohols
- Glycol ethers and glycol ether esters

**Adhesion promoters**
For various wood-plastic composites
- Solventborne: chlorinated and unchlorinated
- Waterborne: chlorinated and unchlorinated

**Additives**
- Eastman SAIB (sucrose acetate isobutyrate)
- Eastman plasticizers
Eastman cellulose esters

Eastman cellulose esters, as a family of polymers, offer a wide range of performance-enhancing properties for wood coatings. They are supplied as 100% solid, free-flowing powders and can be dissolved in a variety of solvents and reactive diluents.

Eastman cellulose acetate butyrate (CAB) resins have been used in wood-coating systems for many years. They find widespread use in high-quality 2K acrylic urethane systems and in the growing trend of radiation-curable systems. Besides these principal coatings applications, Eastman CAB is also used in thermoplastic and acid-curable coatings.

Eastman Solus™ 2100 performance additive possesses improved compatibility with alkyd resins commonly used in wood coating formulations compared to cellulose esters. Alkyd urethane wood coatings for furniture are typically formulated using nitrocellulose resins—particularly where low gloss is required. One of the main issues with this approach has been that the nitrocellulose binders impart excessive yellowing in the coating, even more so than the short-oil alkyd and aromatic isocyanate co-binders.

The incorporation of Solus 2100 performance additive into an alkyd urethane wood coating offers the following benefits:

• Improved resistance to yellowing under UV light
• Improved dry-to-touch time and hardness development
• Excellent flow/leveling and appearance
• Higher solids content at application viscosity for lower VOC levels

Benefits of Eastman CAB resins

Cellulose esters offer wood-coating systems a variety of advantages:

• Fast hardness development that allows early stacking and processing of coated products
• Nonyellowing under influence of UV light
• Excellent flow and leveling characteristics for defect reduction and improved coating appearance
• The correct balance of viscosity and solids content to allow excellent wetting, penetration, and pore definition on "open pore" wood species
• Superior control of silica matting aids for consistent gloss levels at a variety of film thicknesses
• Reduced variation of film thickness due to “picture framing”
• Improved atomization
• User-friendly application characteristics
• Improved adhesion (UV systems)
• Resistance to plasticizer migration
Choosing an Eastman CAB resin for initial screening

The unique structure and composition of cellulose ester materials allows us to modify key attributes of the products to alter solubility, compatibility, hydroxyl content, and molecular weight. This provides a range of products that offers coatings formulators a wide variety of options.

Knowing how cellulose esters are named, one can easily make relative comparisons among them for initial screening in any application. Three variables—butyryl content, hydroxyl content, and viscosity—determine which cellulose ester to screen for a given application. These variables are described by the nomenclature for cellulose esters.

**Figure 1.** Code designation of Eastman cellulose esters, using Eastman CAB 381-0.1

Table 1 provides guidance about the impact of butyryl content, hydroxyl content, or viscosity on film properties.

**Table 1.** Selection considerations

<table>
<thead>
<tr>
<th>For a cellulose ester with greater:</th>
<th>Choose a cellulose ester with:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compatibility</td>
<td>Higher butyryl content</td>
</tr>
<tr>
<td>Solubility</td>
<td>Higher butyryl content or higher hydroxyl content if the solvent blend is high in alcohol</td>
</tr>
<tr>
<td>Reactivity</td>
<td>Higher hydroxyl content</td>
</tr>
<tr>
<td>Toughness</td>
<td>Higher viscosity</td>
</tr>
<tr>
<td>Hardness</td>
<td>Lower butyryl content or higher hydroxyl content</td>
</tr>
<tr>
<td>Chemical resistance</td>
<td>Lower butyryl content</td>
</tr>
<tr>
<td>Flexibility</td>
<td>Higher butyryl content</td>
</tr>
<tr>
<td>Higher solids at fixed viscosity</td>
<td>Lower viscosity</td>
</tr>
<tr>
<td>Moisture resistance</td>
<td>Lower hydroxyl content</td>
</tr>
<tr>
<td>Adhesion</td>
<td>Higher butyryl and hydroxyl content</td>
</tr>
</tbody>
</table>

Generally, Eastman CABs with higher butyryl content are best for initial screening due to greater compatibility with other resins. If compatibility is good with the higher-butyryl esters, others may then be evaluated. In many cases, a lower-butyryl ester may be incompatible with a system while a higher-butyryl ester shows good compatibility. Testing is advised to determine compatibility with the resin of your choice.
Table 2 provides guidance on cellulose esters recommended for various types of wood finishes.

### Table 2. Selector guide for wood coating technologies

<table>
<thead>
<tr>
<th>Type of wood finish</th>
<th>Typical use level, solids, wt%</th>
<th>Suggested Eastman cellulose ester for initial screening</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lacquer</td>
<td>30–60</td>
<td>CAB 381-0.5, CAB 531-1, CAB 551-0.2</td>
</tr>
<tr>
<td>2K alkyd/urea</td>
<td>10–40</td>
<td>CAB 553-0.4</td>
</tr>
<tr>
<td>1K precatalyzed</td>
<td>10–40</td>
<td>CAB 553-0.4</td>
</tr>
<tr>
<td>Sealers</td>
<td>10–30</td>
<td>CAB 551-0.2</td>
</tr>
<tr>
<td>2K polyurethane</td>
<td>5–60</td>
<td>CAB 381-0.1, CAB 381-0.5, CAB 551-0.01, CAB 551-0.2</td>
</tr>
<tr>
<td>High-solids cross-linked coatings</td>
<td>5–15</td>
<td>CAB 551-0.01, Solus 2100</td>
</tr>
<tr>
<td>UV curable</td>
<td>1–5</td>
<td>CAB 381-0.5, CAB 551-0.01, Solus 2100</td>
</tr>
<tr>
<td>Unsaturated polyester</td>
<td>1–10</td>
<td>CAB 551-0.01, CAB 551-0.2</td>
</tr>
</tbody>
</table>

### Industrial wood finishes using Eastman cellulose esters

For more than 40 years, Eastman CAB and Eastman cellulose acetate propionate (CAP) have been used as co-resins or additive raw materials, providing several benefits to 2K PU/acrylics, acid-cured, UV-curing, and other wood coatings technologies.

Additionally, the molecular structure of cellulose ester chains provides unique rheological properties. Eastman CAB solutions demonstrate near-Newtonian flow behavior at certain shear domains, allowing excellent atomization, flow, and leveling very quickly after application. The elastic modulus predominates over viscous modulus, resulting in fast hardness development and excellent film properties.

### Eastman CAB lacquers

Lacquers based on cellulosic resins are versatile wood finishes. CAB has key advantages over nitrocellulose: it is nonyellowing, has superior cold check resistance, and has lower flammability. CAB is the best choice for those finishes where nonyellowing is required. CAB acrylic lacquers are also particularly suitable as topcoats for light-colored wood or light-shaded base coats.

Eastman CAB/acrylic lacquers maintain traditional lacquer qualities such as ease of repair, ease of handling, fast drying, clarity, and superior appearance.

### Formulating tips for lacquers

- Eastman CAB has limited compatibility with alkyd resins. However, if formulated with an alkyd resin, the slowest evaporating solvent in the system should be an aromatic hydrocarbon to ensure blush-free films. It is important to include some aromatic hydrocarbon in the solvent blend to help achieve overall compatibility, solution clarity, and smoothness of Eastman CAB lacquers while reducing solvent costs.
- Lacquers containing Eastman CAB should not be mixed with those containing nitrocellulose because they are generally incompatible.
- Compatibility with alkyls may vary depending on the alkyd type. Testing has shown greater compatibility with resins based on coconut, castor, and soya oils. Eastman suggests testing with your alkyd to confirm compatibility. Additional information is available from your Eastman representative.
- Solus 2100 has shown better capability with alkyd resins and is recommended for use in 2K polyurethane alkyd technology.
**Polyurethane finishes**
Polyurethane wood finishes exhibit outstanding film properties and are commonly used in top-quality furniture with high demand for appearance and chemical resistance. Drying rates, flow out—in particular on open-pore wood species—and surface smoothness can be improved by incorporating Eastman CAB into polyurethane finishes. Most polyurethane formulations are composed of Eastman CAB, polyisocyanate resins, and/or hydroxyl-functional acrylic or polyol resins. The hydroxyls on the Eastman CAB molecules react with isocyanate to form tough, durable urethane networks in addition to the lacquer-like application properties that Eastman CAB provides these coatings. Existing pure polyurethane/acrylic systems may also be modified with low levels (1%–10%) of Eastman CAB to improve flow properties and drying rates.

**Formulating tips for polyurethane finishes**
- No alcohol or water should be present in the solvents; use only urethane-grade solvents.
- Aliphatic isocyanate resins are recommended for better compatibility. They also provide better color stability and yellowing resistance.
- A slight molar excess of isocyanate to hydroxyl functionalities helps ensure superior chemical resistance.

**Acid-cured alkyd/amino conversion varnishes**
Conversion varnishes combine the fast-curing properties of a lacquer with the higher-performance properties of alkali, solvent, water, and heat resistance of a varnish.

The incorporation of Eastman CAB imparts lacquer-like handling to this type of coating. Acid-catalyzed Eastman CAB finishes may also be formulated with hydroxyl-functional acrylic resins in place of alkyds for nonyellowing applications.

**Formulating tips for acid-cured alkyd/amino conversion varnishes**
- High alcohol content in the solvent blend will stabilize the coating and extend catalyzed pot life.
- \( p \)-Toluenesulfonic acid (\( p \)TSA) is often used as a catalyst. Weaker catalysts, such as acid phosphates, will extend pot life but slow cure response.
- In most cases, 3% \( p \)TSA catalyst, based on solids, will provide maximum cure response. Additional catalyst will not improve coating properties and could cause hydrolysis of butyrate esters. The hydrolysis reaction forms butyric acid, which will have little effect on film properties but will cause an unpleasant odor.

**Precatalyzed lacquers**
Eastman CAB/acrylic precatalyzed lacquers are an excellent choice for applications where the discoloration of conventional nitrocellulose/alkyd precatalyzed lacquers is unacceptable. Technically, precatalyzed lacquers are not true lacquers. These coatings are one-package systems usually containing hydroxyl-functional resins and amino resins. They contain weak catalysts that provide a pot life of four months to one year. Although slower to cure than two-part \( p \)TSA-catalyzed systems, precatalyzed lacquers are more convenient to use and perform adequately for many applications. Suggested starting point formulations for clear and white precatalyzed Eastman CAB/acrylic lacquers are available on request.

**Formulating tips for precatalyzed lacquers**
- Alcohol solvents help extend pot life.
- Increasing the solids content of a formula may decrease pot life.
- Typical catalysts are butyl and phenyl acid phosphates.
- Pigments with surface treatments of highly basic pH may decrease formulation stability and film cure or gloss.
UV-curing finishes
Eastman CABs improve the flow and leveling and drying rate of UV-cure finishes. Incorporating 1%–5% Eastman CAB may improve drying rate, adhesion, and flow out. It has been observed that Eastman CAB in small amounts of <1% reduce penetration into porous substrates. Eastman CAB can also help formulators reduce film shrinkage, which has been hypothesized to cause adhesion failures. Eastman CAB is soluble in styrene and many acrylate oligomers commonly used in UV-cure coatings. Besides Eastman CAB, Solus 2100 has shown excellent solubility and can be recommended for use in UV.

Table 3. Viscosity of 5% solutions of Eastman CAB resins in reactive diluents (Brookfield LVTDVII)

<table>
<thead>
<tr>
<th>Monomer</th>
<th>HDDA</th>
<th>TMPTA</th>
<th>DPGDA</th>
<th>TPGDA</th>
<th>IBOA</th>
<th>Styrene</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>5% CAB</td>
<td>5% CAB</td>
<td>5% CAB</td>
<td>5% CAB</td>
<td>5% CAB</td>
<td>5% CAB</td>
</tr>
<tr>
<td>553-0.4</td>
<td>1550</td>
<td>H</td>
<td>1550 (2%)</td>
<td>IG</td>
<td>1190</td>
<td>IG</td>
</tr>
<tr>
<td>551-0.01</td>
<td>29</td>
<td>S</td>
<td>661</td>
<td>S</td>
<td>40</td>
<td>S</td>
</tr>
<tr>
<td>551-0.2</td>
<td>87</td>
<td>SH</td>
<td>2080</td>
<td>S</td>
<td>136</td>
<td>S</td>
</tr>
<tr>
<td>381-0.1</td>
<td>60</td>
<td>S</td>
<td>1670</td>
<td>S</td>
<td>113</td>
<td>S</td>
</tr>
<tr>
<td>321-0.1</td>
<td>53</td>
<td>S</td>
<td>1420</td>
<td>S</td>
<td>93</td>
<td>S</td>
</tr>
<tr>
<td>Solus 2100 performance additive</td>
<td>&lt;10</td>
<td>S</td>
<td>242</td>
<td>S</td>
<td>30</td>
<td>S</td>
</tr>
</tbody>
</table>

Legend
- **HDDA**: 1,6-Hexanediol diacrylate [η = 10cP]
- **TMPTA**: Trimethylolpropane triacrylate [η = 105cP]
- **DPGDA**: Dipropylene glycol diacrylate [η = 15cP]
- **TPGDA**: Tripropylene glycol diacrylate [η = 17.5cP]
- **IBOA**: Isobornyl acrylate [η = 13cP]
- **Styrene**: Styrene acrylate monomer [η = 2.5cP]

- **Viscosity (cP)**
- **Rating**
  - **S**: Soluble, totally clear solution
  - **SH**: Slight haze, barely visible to the naked eye
  - **H**: Hazy, very visible, yet still translucent
  - **IG**: Large quantity of partially solubilized translucent gel particles that cause haze or sediment
  - **I**: Insoluble/very little soluble material
  - **NA**: Not applicable (viscosity unmeasurable due to insolubility)

Eastek™ polymer dispersion
Sulfopolyester building blocks are comprised of glycols, aromatic acids, and 5-sodium sulfoisophthalic acid (SSIPA). The glycol ratio influences hydrophobicity and stiffness; the SSIPA content dictates dispersibility in water. Once dispersed, sulfopolyesters spontaneously form small micellar aggregates. Eastek products are colloidal dispersions (Figure 1) with extremely small particle size (10–50 nm in diameter).

This unique polymer chemistry offers several advantages in waterborne coating systems. However, there are a number of significant differences versus commonly used waterborne binders. Eastek™ 1200 polymer dispersion, the most alcohol-resistant dispersion in this family of products, may be resistant enough for topcoat applications. We recommend the use of Eastek products in primer/intermediate coat systems. The solids content, ~30% w/w, of Eastek dispersion better suits these coating layers.
Benefits
The benefits of Eastek polymer dispersions as binders in wood-coating primers include:
• Outstanding “anfeuerung” (wet look, clarity, warmth) on a variety of wood types
• Harmonizing effect: improved penetration into wood of nonuniform density, ensuring uniform
  color and colored stain acceptance
• Low odor
• Nonskinning
• Fast drying and hardness development
• Excellent crosscut adhesion
• Very high gloss and clarity
• Easy to formulate
• Excellent flexibility and resistance to mechanical damage with and without topcoat systems
• Excellent lightfastness

Solvents
Eastman solvents are used in all stages of the wood-finishing process. Eastman is dedicated to being a
reliable supplier of traditional lacquer solvents as well as specialty solvents useful in formulating wood
coatings to meet changing environmental regulations. An important issue faced by the wood-finishing
industry is compliance with hazardous air pollutant (HAP) regulations. The majority of Eastman solvents
are non-HAPs.

For specific reformulations needs and information about product availability in your region, contact your
Eastman representative.

The following are examples of solvents that are particularly useful in wood finishes.

Ketones
Eastman MAK (methyl n-amyl ketone) and Eastman MIAK (methyl isoamyl ketone) are non-HAP (HAP
content <1%), highly active retarder solvents for lacquers, polyurethanes, and conversion varnishes.
Because of their strong solvency, low weight per volume, and low density, Eastman MAK and Eastman
MIAK are excellent choices for higher-solids systems. These ketones also work well in higher-solids
lacquers applied by high-pressure or hot-spray techniques.

Eastman MPK (methyl n-propyl ketone)1 is a highly active solvent that may be used to replace portions
of commonly used solvents such as MEK and MIBK. It has an evaporation rate of 2.3 and provides
excellent solvency for most wood-coating resins.

Esters
Eastman n-butyl acetate is a non-HAP, medium-evaporating, workhorse solvent for many lacquers,
sealers, and conversion varnishes. It is the most popular “middle” solvent and provides great flow
properties.

Eastman IBIB (isobutyl isobutyrate) is an HAP-free, economical retarder solvent useful in nitrocellulose
lacquers and polyurethane coatings. It has very low surface tension and extremely low water miscibility.
IBIB can be a useful solvent to improve flow in warm, dry, or drafty application conditions.

Eastman n-butyl propionate is a non-HAP, slow-evaporating, urethane-grade ester with good solvency
for most coating resins. It can be a useful retarder solvent in lacquers and ambient cure enamels. Its slow
evaporation rate allows for flow and leveling but does not prevent the quick rubbing and sanding of the
lacquer. n-Butyl propionate could be used as a replacement for xylene in coating applications such as
high-solids thermoset enamels, processing solvents for high-solids acrylic resins, and electrostatically
applied coatings.

1May contain up to 10% MIBK by weight
**Eastman n-propyl propionate** is a non-HAP, medium-evaporating, urethane-grade ester with good solvency for most coating resins. It could be used as a replacement for xylene in coating applications such as lacquers, enamels, processing solvents for high-solids acrylic resins, and electrostatically applied coatings.

**Eastman EEP (ethyl-3-ethoxypropionate)** is a high-performance ether-ester solvent that has utility in wood finishes. EEP’s high electrical resistance makes it useful for electrostatic spray applications. EEP may be preferred over PM acetate because of its lower density and slower evaporation rate.

**Eastman methyl acetate, high purity** is a VOC-exempt (U.S.A.), non-HAP solvent useful in wood finishing that does not cause blushing. It has similar solvent strength and evaporation rate to acetone.

**Alcohols**

**Eastman isobutanol (isobutyl alcohol)** is a primary alcohol of high purity that has properties similar to those of n-butyl alcohol. This similarity has led to the use of isobutyl alcohol as a supplement or replacement for n-butyl alcohol in many applications. A relatively slow-evaporating latent solvent in lacquers, isobutyl alcohol is effective at reducing the viscosities of many formulations while simultaneously promoting flow and retarding blushing. In coatings cross-linked with melamine resins, alcohols such as isobutyl alcohol are commonly used to improve the coating’s viscosity stability. In addition to its use as a solvent, isobutyl alcohol can be substituted for n-butyl alcohol as a diluent-reactant in the manufacture of certain urea-formaldehyde and melamine-formaldehyde resins.

**Glycol ethers and glycol ether esters**

**Eastman EB solvent (ethylene glycol monobutyl ether)** is a non-HAP, colorless liquid with a mild odor and high dilution ratio with petroleum hydrocarbons. It is soluble in alcohol and water. It is very useful in formulating lacquers with good blush resistance.

**Eastman PM acetate (propylene glycol monomethyl ether acetate)** is a non-HAP, colorless, slow-evaporating glycol ether ester. It is active for several commonly used coating polymers, including CAB, nitrocellulose, acrylics, and epoxy and phenolic resins. The combination of slow evaporation rate and good solvent activity makes Eastman PM acetate an effective retarder solvent for use in lacquers and enamels as well as in thinners.

**Adhesion promoters**

The market for wood-filled polyolefin composites is currently growing in all regions of the world. The main industrial application areas are door frames, decorative profiles, siding, and furniture. The amount of wood fiber or flour added to polypropylene profiles typically varies between 30% and 85%, depending on the end use and the manufacturer. In most cases, a good balance of cost and performance is seen at levels of ~50% wood loadings.

Eastman has a range of adhesion promoters that allow such materials to be painted as natural wood building products.

**Eastman technical service laboratories**

Eastman has technical service laboratories around the world to assist with wood coatings development. If you have questions about formulating, regulations, products, or other related areas, contact an Eastman technical service representative.
Additives

To complete our full range of products available to the wood coatings industry, we offer several additives to enhance the performance properties of wood coating formulations. Contact your Eastman representative about product availability in your region.

**Eastman SAIB (sucrose acetate isobutyrate)**

Eastman SAIB is used as an extender resin in wood sealers and topcoats. It may serve to increase nonvolatile content by levels of 10%–15% solids with no significant increase in viscosity. While Eastman SAIB has some plasticizing effect at these levels, it does not cause appreciable film softening and often improves adhesion. Eastman SAIB has excellent solubility and compatibility with resins and other modifiers and has very good light stability. In nitrocellulose lacquers that also contain hard resins and plasticizers, Eastman SAIB can replace the nonoxidizing alkyd resins commonly used to produce a low-viscosity lacquer at a given solids level. Starting point formulas for Eastman SAIB in nitrocellulose wood lacquer are available on request.

**Eastman Optifilm™ enhancer 400**

Eastman Optifilm™ enhancer 400 is an excellent alternative to traditional phthalate plasticizers. It has been shown to be more efficient than *ortho*-phthalates in improving flexibility of lacquer films. Optifilm 400 product also has very good weathering stability.

**Plasticizers**

Eastman offers the following plasticizers that may be used in wood finishes:

- Eastman DOP plasticizer (dioctyl phthalate)
- Eastman 168™ non-phthalate plasticizer (dioctyl terephthalate)
- Eastman 425 plasticizer (blend of dioctyl terephthalate and diethylene glycol dibenzoate)
- Eastman DOA plasticizer (dioctyl adipate)
- Eastman TOTM plasticizer (trioctyl trimellitate)
- Eastman VersaMax™ Plus plasticizer
- Benzoflex™ LA-705 plasticizer
- Benzoflex™ 50 plasticizer
- Benzoflex™ 9-88 plasticizer
- Benzoflex™ 9-88SG plasticizer
- Eastman Optifilm™ enhancer 300
- Eastman Optifilm™ enhancer 400

**We’re here to help**

Whatever your formulation needs, Eastman offers solutions for industrial wood coating applications that can help you improve appearance, performance, protection unit cost, and regulatory requirements while balancing cost and value.

Our chemistry and formulation experts or your authorized Eastman distributor are available to help you select the best products for your specific application needs.

Additional information on the properties and performance of specific cellulose esters, solvents, and other Eastman products for industrial wood coatings, along with formulation guides and application details, are available at [Eastman.com/CE](http://Eastman.com/CE).
As the world’s leading supplier of specialty cellulose esters for more than 85 years, Eastman has a long history of reliably supplying customers with consistently high-quality products manufactured using advanced processes and controls. With a diverse portfolio of more than 50 cellulose esters—CA, CAB, CAP, and C-A-P—for a variety of applications along with years of formulating experience, our technical experts can provide guidance to help customers select the best cellulose ester or blend to achieve the specific performance desired for their unique application. Over the years, we’ve introduced innovative products that help meet customer needs and market demands—most recently Eastman Solus™ performance additive for high-solids coatings and Eastman membrane material products for membrane filtration. Eastman works with regulatory agencies and industry associations on behalf of our customers to advocate for policies that allow industries to thrive, enabling sustainable innovation. At Eastman, our goal is to enhance the quality of life in a material way.